CLAIMS

1. A substrate, suitable for the preparation of a composite membrane, which substrate comprises a porous matrix of fibres, characterised in that the fibres are bound with a binder comprising both silica and a fluorinated hydrocarbon polymer.

2. A substrate according to claim 1, wherein the silica comprises a colloidal aqueous solution, or a silica powder dispersed in water.

3. A substrate according to claim 1 or claim 2, wherein the fluorinated hydrocarbon polymer comprises one or more non-ion-conducting polymer(s).

4. A substrate according to any preceding claim wherein the non-ion-conducting polymer is selected from the group consisting of polytetrafluoroethylene (PTFE), fluorinated ethylene-propylene (FEP), tetrafluorethylene-ethylene (ETFE) copolymers, poly(vinylfluoride) (PVF) and poly(vinylidinefluoride) (PVDF).

5. A substrate according to any preceding claim, which comprises a colloidal silica:PTFE mixed binder.

6. A substrate according to any preceding claim, wherein the ratio of silica to polymer is in the range of from 95:5% to 5:95% based on w/w solid materials in the binder mixture.

7. A substrate according to claim 6 wherein the ratio of silica to polymer is in the range of from 70:30% to 30:70% based on w/w solid materials in the binder mixture.

8. A substrate according to claim 6 or claim 7 wherein the ratio of silica to polymer is about 50:50%, based on w/w solid materials in the binder mixture.

9. A substrate according to any preceding claim, wherein the mixed binder is in the form of a dilute aqueous dispersion.

10. A substrate according to claim 9 wherein the mixed binder is in the form of a dilute aqueous dispersion of about 10wt% solids in the aqueous solution.

11. A substrate according to any preceding claim, wherein the fibres comprises glass and/or silica.

12. A substrate according to any preceding claim, wherein the fibres have a diameter in the range of from 0.1μm to 50μm.

13. A composite membrane comprising a porous substrate of fibres and at least one ion-conducting polymer, characterised in that the porous substrate comprises fibres that are bound with both silica and a fluorinated hydrocarbon polymer.

14. A membrane according to claim 13 which, when tested by the method described herein in the Examples, results in less than or equal to about ±16% change in its area; preferably, ≤ ±10% area change; more preferably, in the range of from about 0 to about 6% expansion.

15. A process for preparing a porous substrate according to any one of claims 1 to 12, which process comprises applying an aqueous dispersion of silica and a fluorinated hydrocarbon polymer to a porous matrix of wet fibres.

16. A process for the manufacture of a substrate according to any one of claims 1 to 12, which process comprises

(a) dispersing the fibres in water to form a slurry:

(b) depositing the slurry onto a mesh bed to form a network;

(c) drying and compacting the fibre network; and

(d) applying, before or after step (c), a dispersion of the binder.

17. A process for the manufacture of a membrane according to claim 13 or claim 14, which process comprises

(i) forming a porous substrate of, preferably randomly orientated individual, mixed amorphous silica fibres bound with a binder by a process according to claim 16; and, thereafter,

(ii) impregnating the fibre matrix substrate with a polymeric material to produce a membrane.

18. A process according to claim 17, wherein step (ii) is carried out by nip roller coating of the substrate to fill it with a solution of ion-conducting polymeric material, and further compaction and drying of the membrane.

19. A membrane electrode assembly comprising a substrate according to any one of claims 1 to 12 and/or a composite membrane according to claim 13 or claim 14.

20. A fuel cell comprising a substrate according to any one of claims 1 to 12 and/or a composite membrane according to claim 13 or claim 14.